## Ecological Physiology

**Avian Energetics.** Papers from a symposium, Provincetown, Mass., Oct. 1973. RAYMOND A. PAYNTER, JR., Ed. Nuttall Ornithological Club (c/o Museum of Comparative Zoology, Harvard University), Cambridge, Mass., 1974. viii, 334 pp., illus. $17. Publications of the Nuttall Ornithological Club, No. 15.

This is a collection of four superb treatises by James R. King, William A. Calder, III, Robert E. Ricklefs, and Vance A. Tucker which were presented in abstracted form at a symposium held in observance of the Nuttall Ornithological Club's centennial. Each exposition is followed by prepared comments by four distinguished avian energeticists: George A. Bartholomew, William R. Dawson, S. Charles Kendeigh, and Eugene P. Odum.

In the chapter "Seasonal allocation of time and energy resources in birds" King delineates the diversity of annual cycles of migration, molt, reproduction, mating systems, and social organization. He reviews physical and biological factors that affect avian energy budgets and surveys the methods for estimating energy consumption in free-living birds. King provides a comprehensive synthesis of the available data on daily energy expenditure in free-living birds and mammals and describes the need for future research in six areas. He concludes by forecasting that through the joint efforts of physiologists, ecologists, and population biologists will come data for models "that will give us better insights into the temporal and social organization of bird species and communities reflecting evolutionary compromises in the allocation of time and energy."

The chapter by Calder is in two parts: (i) the importance of body size in avian energetics and (ii) body size and hummingbird energetics. Calder describes in an unusually lucid manner the allometric relationships between body size and components of energetics: metabolism (for example basal, existence, summit, and flight), physiological determinants of oxygen supply (for example cardiac output, breathing frequency, and tidal volume), and factors controlling fuel supply (for example territory size and gut mass). In the second part he examines the time and energy budgets of hummingbirds and their methods of conserving energy by hypothermic torpor and by selecting microhabitats that moderate heat loss to the environment. Much of his work illustrates a strong integration of field and laboratory measurements, an emerging focus in ecological physiology.

Ricklefs's chapter on "Energetics of reproduction in birds" is a monumental synthesis (122 pages, 312 references). He begins with a brief review of the energy equivalents of foods, respiratory gas exchange, and avian biomass and of different measures of adult energy metabolism. This prepares the reader for a robust review and synthesis (including both published and unpublished data) of the energetics of egg formation, incubation, and growth. This extensive analysis demonstrates Ricklefs's superior ability to understand and explain the dimensions of a problem. He concludes with a treatment of the influence of environmental factors on energy expenditure by adults and clutch size, modes of development, and rate of growth. This discourse focuses clearly on the potential value of energetics in understanding the evolution of avian reproductive strategies.

In the final chapter, entitled "Energetics of natural avian flight," Tucker examines the potential differences in the power required for flight in a wind tunnel and under natural conditions. He presents an elegant model which describes the effect of altitude, air temperature, and vertical and horizontal air movements on flight velocity and power requirements. This model is used to examine the complexities of flight range, and Tucker concludes that the longest nonstop flights of birds are physiologically possible only if the birds are aided, or at least not hindered, by the wind. Tucker's paper blends the aerodynamic and physiological approaches to flight energetics into a coherent and very useful body of information.

This book is indispensable for avian physiologists and ecologists. I agree with G. A. Bartholomew that "these treatises will represent the base line from which all subsequent studies involving the energetics of birds must start."

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## Membranes

**Perspectives in Membrane Biology.** Proceedings of a symposium, Oaxaca, Mexico, Jan. 1974. SERGIO ESTRADA-O. and CARLOS GITLER, Eds. Academic Press, New York, 1974. xvi, 660 pp., illus. $24.50.

The symposium of which this book is an outgrowth was organized to expose (young) Mexican scientists to some of the perspectives of membrane biology. The main function of the meeting was therefore to be pedagogical, to present ideas and not to present "recent data." Consequently, one approaches this book with rather high expectations, which are largely fulfilled.

The emphasis of the book is on the chemistry and biochemistry of cell and organelle membranes. The two main ideas are, predictably, the plasticity of membranes and the coupling between metabolism and ion transport.

The first and largest section is concerned with membrane structure. The articles are well chosen and very readable. They range from x-ray analysis of lipid-water mixtures (Luzzati), to nuclear magnetic resonance studies of lipid bilayers (Pethica and Tiddy), to disassembly and reassembly of the Semliki forest virus (Simons *et al.*). The last article, by Gitler and Klip, is a stimulating counterpoint to techniques and ideas presented in other articles (Bretscher, Singer). The major topics are the use of chemical labels (and the dangers involved in interpreting the results), the use of encounter fluorescence quenching, and lipid-protein interactions.

The second section deals with active ion transport (Kaback, Skou) and the relationship between metabolism and ion transport across cell membranes (Peña).

The next two sections cover energy transduction in mitochondrial and photosynthetic membranes. The emphasis in the first two articles is on the role of cations and cation translocation in oxidative metabolism. The next three articles deal with the measurement of localized or delocalized electrical fields by the use of optical methods and extrinsic (Chance *et al.*) or intrinsic (Crofts, Witt) probes. Cone gives a very lucid review of visual excitation and especially of membrane fluidity as seen in the frog rod disk-membranes when rhodopsin is used as a probe.

The next topic is the role of cell membranes as information transducers in hormone action, cell recognition, and immunological responses. Articles by Cuatrecasas and Bennett and by Marinetti *et al.* give extensive reviews of hormone binding to plasma membranes and the information transduction events occurring in the membrane. Melchers discusses the regulation of immunoglobin M synthesis and the question of membrane-bound antibodies. Nathenson and Raff *et al.* review the complementary topic of membrane-bound antigens, as well as ligand-induced redistribution of membrane macromolecules.

The final section is devoted to the reconstitution of specific membrane functions and includes articles by Montal on reconstitution in planar decane-free artificial lipid bilayers, by Racker on the reconstitution of active ion transport in lipid vesicles, and by Läuger *et al.* on the systematic and stepwise incorporation of